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Chemical Composition of the Pits of Selected Date Palm Cultivars Grown in the Qassim Region, Saudi Arabia

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ABSTRACT. In this study, the pits of eleven selected date palm cultivars grown in the Qassim region were analyzed (on dry weight basis) for their elemental composition as well as organic constituents. Regarding the elemental composition, their concentration ranges in the pits of the studied cultivars were as follows: Nitrogen, 0.81-1.20%; phosphorus, 0.186-0.259%; potassium, 0.363-0.403%; calcium 0.357-0.422%; magnesium, 0.104-0.153%; chloride, 0.269-0.507%; sodium 0.029-0.043%; iron, 124.8-172.0 $\mu g\ g^{-1}$ manganese, 17.0-24.8 $\mu g\ g^{-1}$; zinc, 8.3-18.3 $\mu g\ g^{-1}$; and copper, 8.8-17.3 $\mu g\ g^{-1}$, while the concentration ranges of the organic constituents were as follows: total carbohydrates, 57.645-68.918%; total sugars, 3.773-5.830; total proteins, 5.11-7.52%; crude fats, 8.67-12.31%; and tannins, 1.59-3.48%. Significant differences were also observed among the studied cultivars in most of their mineral and organic constituents.

Significant correlation coefficients were found among the mineral composition and organic constituents of the pits of the selected cultivars in most cases.

Dates (*Phoenix dactylifera* L.) are very nutritious as they contain high amounts of sugars, proteins, pectins, gums, vitamins and minerals. The annual production of dates in Saudi Arabia was estimated as 500,000 metric tons (FAO 1989). It is worthwhile to mention that, in addition to the high nutritious value of dates, many date palm parts are useful medicinally. The terminal bud "djoummar" is used for intestinal haemorrhage, diarrhoea and jaundice. Dates are also used in medication

designed to purge, clear enigmatic or to regulate the urine, in vaginal pessaries, with other ingredients they enhance fertility and relieve cough. Green dates are reputed as aphrodisiac and tonic. Date palm pollen grains have a gonadotrophic activity, as their extract increase the weight of ovaries, uteri, testes and seminal vesicles. The steroid hormone estrone has been identified from both seeds and pollens. Moreover, the pollens contain cholesterol, the precursor of steroid hormones in animals. The pollens also contain rutin, quercetin, ß-amyrin, ß-sitosterol, a steroid saponin and a glucoprotein which has a gonadotrophic activity (Rizk and Al-Nowaihi 1989). Date pits comprise about 10% of fruit weight of some cultivars (Nour *et al.* 1986 and El-Kassas 1986). Thus significant amounts of pits can be made available, especially after the progress in date industrialization, in which pits are removed and replaced with nuts. The increase of world population has increased the need for animal proteins. Accordingly, many countries started feeding livestock with date by-products including the pits (Al-Yousef *et al.* 1986, El-Gasim *et al.* 1986).

The objective of this study is to analyze the pits of eleven selected cultivars from the Qassim region for their contents of total carbohydrates, total sugars, total proteins, crude fats, tannins and minerals.

Materials and Methods

Date palm pits:

Eleven selected date palm cultivars were used in this study. These cultivars are: Barhi, Sukkari, Rezaiz, Maktoomy, Kwairi, Shagra, Sullaij, Nabtet Aly, Om El-Khashab, Helwa and Sabbaka. These cultivars were grown in the Research Experimental Station, College of Agriculture and Veterinary Medicine, King Saud University, Qassim, Saudi Arabia. Each cultivar was represented by four fruiting date palm trees (one tree for each replciate). All trees were of the same age (about 10 years) and received regular agricultural practices. Samples of 100 date pits were extracted from fruits (at Rutab stage) for each replicate, washed with distilled water, dried in an oven at 70 °C and then ground into a fine powder. The average pit weights of the above mentioned studied cultivars are: 0.59, 1.55, 0.87, 1.03, 0.87, 0.91, 1.04, 1.11, 1.05, 0.81 and 0.83 g, respectively.

Determination of elemental composition:

Powdered pits were digested according to Evenhuis and Deward (1980) and analyzed for phosphorus, potassium, calcium, magnesium, sodium, iron, manganese, zinc and copper. Phosphorus was determined colorimetrically using a Jenway 6100 Spectrophotometer. Sodium and potassium were estimated using a Flame Photometer. Calcium and magnesium were determined by the fersenate method

according to Cheng and Bray (1951), while iron, manganese, zinc and copper were determined by the Perkin Elmer Atomic Absorption Model 305 B. Chloride was determined by the silver nitrate method (Jackson and Brown 1955).

Determination of total carbohydrates, total sugars, total proteins, crude fats and tannins:

Total carbohydrates and sugars were determined according to Dubois *et al.* (1965), while crude proteins were determined by multiplying nitrogen determined by the micro Kjeldahl method (AOAC 1980) by 6.25. Crude fats and tannins were also estimated according to AOAC 1980.

Statistical analysis:

The experiment was randomized complete block design and the means were compared using the Duncans Multiple Range test and correlation coefficients between the components of date pits were calculated according to Snedecor and Cochran (1972).

Results and Discussion

The elemental composition of the pits of eleven selected date cultivars was determined (Table 1). It is evident that there are significant differences in nutrient elemental composition between one cultiver and another in most cases. The variation in the contents of potassium, calcium, iron and zinc among the studied cultivars are in agreement with those reported by Saad *et al.* (1986). The obtained results have also shown that the concentration ranges were as follows: N, 0.81-1.20%; phosphorus, 0.186-0.259%; potassium, 0.363-0.403%; calcium, 0.357-0.422%; magnesium, 0.104-0.153%; chloride, 0.269-0.507; sodium, 0.029-0.043%; iron, 124.8-172.0 $\mu g\ g^{-1}$; manganese, 17.0-24.8 $\mu g\ g^{-1}$; zinc, 8.3-18.3 $\mu g\ g^{-1}$; and copper, 8.8-17.3 $\mu g\ g^{-1}$. The concentration of nitrogen, potassium, chloride, and copper in this study were in agreement with those reported by Saad *et al.* (1986) on Saudi date palm cultivars, while phosphorus, calcium and magnesium were higher, and iron and zinc were lower (Table 4).

Regarding the organic composition of the pits of selected cultivars (Table 2), it is evident that their concentration ranges are as follows: total carbohydrates, 57.645-68.918%; total sugars, 3.773-5.830%; total proteins, 5.11-7.52%; crude fats, 8.67-12.31%; and tannins, 1.59-3.48%. It is also evident that there were significant differences observed among the studied cultivars in most cases (Table 2).

The foregoing results regarding the total carbohydrate content in the pits of the

Table 1. Elemental composition (on dry weight basis) of the pits of eleven date palm cultivars

Cultivars	%							μg g^{-1}			
	N	**P**	**K**	**Ca**	**Mg**	**Cl**	**Na**	**Fe**	**Mn**	**Zn**	**Cu**
Barhi	b 1.02	b 0.208	c 0.364	ab 0.415	c 0.104	bc 0.384	ab 0.038	cd 135.0	b 22.0	cde 10.8	b 14.3
Sukkari	a 1.20	b 0.190	b 0.380	bc 0.372	a 0.149	cd 0.333	cd 0.031	ab 161.8	cd 18.0	a 18.0	a 17.3
Rezeiz	b 1.03	b 0.193	c 0.364	abc 0.393	abc 0.120	a 0.507	cd 0.029	d 124.8	bc 20.3	bcd 12.8	cd 10.3
Maktumy	b 0.98	b 0.191	c 0.363	ab 0.408	abc 0.131	b 0.414	cd 0.029	abc 156.8	d 17.0	b 14.8	d 8.8
Kwairi	de 0.84	a 0.259	b 0.383	a 0.422	a 0.151	cd 0.340	bc 0.035	d 126.3	bcd 19.0	bc 14.0	cd 10.0
Shagra	bc 0.96	b 0.190	b 0.380	abc 0.386	a 0.145	cd 0.329	cd 0.032	bcd 138.3	bcd 19.8	bc 14.3	cd 10.3
Sullaij	cd 0.90	b 0.202	b 0.382	bc 0.372	a 0.153	cd 0.362	bcd 0.032	abc 153.8	b 21.8	bc 14.3	cd 10.8
Nabtet Aly	cd 0.89	b 0.208	a 0.399	abc 0.399	a 0.153	cd 0.330	bcd 0.033	cd 132.3	bcd 20.0	de 10.3	d 9.3
Om El-Khashab	cb 0.96	a 0.244	a 0.403	ab 0.419	abc 0.128	cd 0.340	a 0.042	a 172.0	a 24.8	e 8.3	d 9.0
Helwa	e 0.82	b 0.198	b 0.380	b 0.357	ab 0.142	e 0.269	a 0.043	cd 133.3	cd 18.3	a 18.3	c 11.8
Sabbaka	de 0.86	b 0.186	b 0.383	abc 0.401	bc 0.112	de 0.311	bcd 0.032	bcd 143.0	bcd 20.0	cde 11.0	cd 11.0

Means with the same letter are not significantly different.

Table 2. The organic composition (on dry weight basis) of pits of eleven date palm cultivars

Cultivars	Total Carbohydrates %	Total Sugars %	Total Proteins %	Crude Fats %	Tannins %
Barhi	c 57.810	b 4.450	b 6.35	a 11.86	e 2.22
Sukkari	bc 63.384	a 5.830	a 7.52	bc 9.81	de 2.45
Rezeiz	bc 58.881	bc 4.368	b 6.44	c 9.63	f 1.59
Maktumy	bc 60.382	a 5.490	b 6.12	a 12.13	bc 3.05
Kwairi	bc 60.147	a 5.490	de 5.23	bc 10.12	e 2.27
Shagra	bc 58.546	bc 4.397	bc 6.02	b 10.56	cd 2.77
Sullaij	bc 60.382	c 3.773	cd 5.63	d 8.67	de 2.46
Nabtet Aly	c 57.645	bc 4.162	cd 5.58	c 9.51	cd 2.73
Om El-Khashab	a 68.918	bc 4.247	bc 6.02	a 11.66	e 2.34
Helwa	bc 62.884	bc 4.352	e 5.11	a 11.63	ab 3.33
Sabbaka	ab 63.914	bc 4.210	de 5.40	a 12.31	a 3.48

Means with the same letter are not significantly different.

Table 3. Correlation coefficients between chemical components in the pits of eleven date palm cultivar

Chemical Components	Chemical components															
	N	P	K	Ca	Mg	Cl	Na	Fe	Mn	Zn	Cu	Total Carbohydrates	Total Sugars	Total Proteins	Crude fats	Tannins
P	–0.247															
K	*–0.311	*0.393														
Ca	–0.048	*0.354	0.060													
Mg	–0.109	0.080	*0.313	*–0.424												
Cl	*0.382	–0.047	*–0.456	0.205	–0.245											
Na	*–0.302	*0.531	*–0.362	–0.026	–0.007	*–0.434										
Fe	*0.377	–0.137	0.163	0.064	0.075	–0.033	–0.096									
Mn	–0.016	0.263	0.213	0.243	–0.252	–0.016	0.250	0.124								
Zn	0.191	–0.254	*–0.345	*–0.375	0.256	–0.080	–0.038	0.034	*–0.419							
Cu	*0.493	–0.154	–0.137	–0.223	–0.028	–0.158	0.053	–0.005	–0.139	0.198						
Total carbohydrates	0.025	0.145	*0.445	–0.012	0.198	–0.195	0.256	*0.495	0.180	–0.130	0.0.32					
Total sugars	*0.361	0.027	–0.195	0.117	0.084	0.133	–0.257	0.167	*–0.437	*0.337	0.288	0.047				
Total proteins	*0.999	–0.249	*–0.308	–0.048	–0.107	*0.380	*–0.303	*0.378	–0.014	0.190	*0.493	0.027	*0.359			
Crude fats	–0.124	–0.061	–0.177	0.235	*–0.427	–0.177	0.250	0.173	–0.019	–0.135	–0.090	0.256	–0.010	–0.126		
Tannins	*–0.389	–0.261	0.094	–0.123	0.003	*–0.631	0.203	0.033	–0.253	0.173	–0.069	0.105	–0.049	*–0.387	*0.421	

* Significant at 0.05.

selected cultivars are generally in accordance with those reported by Dowson and Aten (1962) and Rizk and Al-Nowaihi (1989). The total proteins in the selected pits of this study are also generally in accordance with those reported by Saad *et al.* (1986) on Saudi date cultivars. However, total proteins and crude fats in this study are generally higher than those reported by Dowson and Aten (1962). Crude fats were also higher than those reported by Saad *et al.* (1986) and Rizk and Al-Nowaihi (1989) on pits of date cultivars (Table 4).

Table 4. Comparison of elemental and organic composition in the present study with those previously reported

Component	Values of the Present Study	Values of Present Studies
N	0.81 - 1.20%	0.83 - 1.13% (Saad *et al.* 1986)
P	0.186 - 0.259%	0.084 - 0.131% (Saad *et al.* 1986)
K	0.363 - 0.403%	0.38 - 0.54% (Saad *et al.* 1986)
Ca	0.357 - 0.422%	0.083 - 0.160% (Saad *et al.* 1986)
Mg	0.104 - 0.153%	0.050 - 0.085% (Saad *et al.* 1986)
Cl	0.269 - 0.507%	0.460 - 0.610% (Saad *et al.* 1986)
Fe	124.8 - 172 $\mu g\ g^{-1}$	275.0 - 562.6 $\mu g\ g^{-1}$ (Saad *et al.* 1986)
Zn	8.3 - 18.3 $\mu g\ g^{-1}$	17.60 - 53.75 $\mu g\ g^{-1}$ (Saad *et al.* 1986)
Cu	8.8 - 17.3 $\mu g\ g^{-1}$	5.0 - 12.5 $\mu g\ g^{-1}$ (Saad *et al.* 1986)
Total carbohydrates	57.645 - 68.918%	62.51% (Dowson and Aten 1962) 60 - 70% (Rizk and Al-Nowaihi 1989)
Total proteins	5.11 - 7.52%	5.22% (Dowson and Aten 1962) 5.21 - 7.05% (Saad *et al.* 1986) 7.0% (Rizk and Al-Nowaihi 1989)
Crude fats	8.67 - 12.31%	8.49 - 8.80% (Dowson and Aten 1962) 6.11 - 8.58% (Saad *et al.* 1986) 6.8% (Rizk and Al-Nowaihi 1989)

Since samples studied in this investigation were collected from trees of similar age and grown under the same conditions and soil; it is obvious that differences in pit components (elemental and organic) are probably due to varietal effects.

The correlation coefficient between the constituents of date pits of the studied cultivars as presented in Table (3) have indicated that there are negative correlation coefficients between nitrogen and each of potassium, sodium and tannins; between potassium and each of chloride, zinc and total proteins; between calcium and each of magnesium and zinc; between magnesium and crude fats; between chloride and each of sodium and tannins; between sodium and total proteins; between manganese and each of zinc and total sugars and between total proteins and tannins. On the other hand, significant positive correlations were observed between nitrogen and each of chloride, iron, copper, total proteins and total sugars; between phosphorus and each of potassium, calcium and sodium; between potassium and each of magnesium, sodium and total carbohydrates; between chloride and total proteins; between iron and each of total carbohydrates and total proteins; between zinc and total sugars; between copper and total proteins; between total sugars and total proteins and between crude fats and tannins (Table 3). No other significant differences were found.

From this study, it can be concluded that the date palm pits of the studied cultivars are rich in some minerals, carbohydrates, total sugars, total proteins and crude fats. Therefore, they can be used for feeding livestock or mixed with other forages or fodder crops.

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المكونات الكيميائية لأنوية بعض أصناف نخيل البلح النامية في منطقة القصيم - المملكة العربية السعودية

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أجريت هذه الدراسة لتقدير المحتوى المعدني والعضوي (على أساس الوزن الجاف) لأنوية احدى عشر صنفاً من أصناف نخيل البلح النامية في منطقة القصيم . وقد تراوحت تركيزات المحتوى المعدني ما يلي : النيتروجين ٠,٨١ - ١,٢٠ ٪ الفسفور ١٨٦,٠-٢٥٩,٠ ٪ ، البوتاسيوم ٣٦٣,٠-٤٠٣,٠ ٪ ، الكالسيوم ٣٥٧,٠-٤٢٢,٠ ٪ ، الماغنسيوم ١٠٤,٠ - ١٥٣,٠ ، الكلوريد ٢٦٩,٠-٥٠٧,٠ ، الصوديوم ٠٢٩,٠-٠٤٣,٠ ٪ ، الحديد ٨,١٢٤-١٧٢,٠ ميكروجرام/ جرام ، المنجنيز ٠,١٧-٨,٢٤ ميكروجرام/ جرام ، الزنك ٣,٨-١٨,٣ ميكروجرام/ جرام ، النحاس ٨,٨-٣,١٧ ميكروجرام/ جرام .

وتراوحت تركيزات المكونات العضوية ما يلي : المواد الكربوهيدراتية ٦٤٥,٥٧-٩١٨,٦٨ ٪ ، السكريات الكلية ٧٧٣,٣-٨٣٠,٥ ، البروتينات الكلية ١١,٥-٥٢,٧ ٪ ، الدهون الخام ٦٧,٨- ٣١,١٢ ٪ والتانينات ٥٩,١-٤٨,٣ ٪ . اختلف المحتوى المعدني والعضوي لأنوية الأصناف -تحت

الدراسة- معنوياً في معظم الحالات بصفة عامة . وجدت علاقات تلازم معنوية بين المحتويات المعدنية والعضوية لأنوية هذه الأصناف تحت الدراسة .